

Technologies Enabling Exploration of Skylights, Lava Tubes and Caves

Completed Technology Project (2011 - 2012)



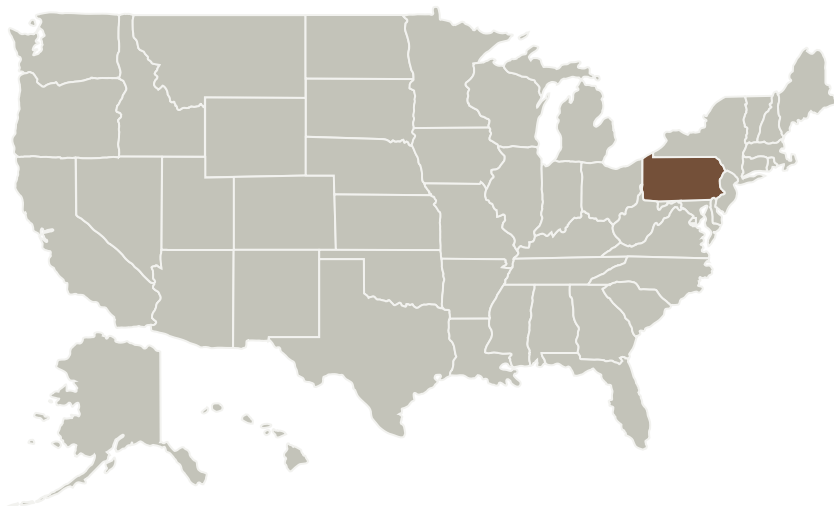
Project Introduction

Missions to date have orbited and roved, but sub-planetary worlds elude exploration. This investigation proposes to develop technology for venturing underground and conceiving mission architectures for robotic expeditions that explore skylights, lava tubes and caves. The investigation will identify effective designs for mobile robot architecture to explore sub-planetary features. By creating and implementing robotic technology to explore skylights, lava tubes, caves and canyons, this investigation will pioneer sub-planetary exploration.

Anticipated Benefits

This investigation proposes to develop technology for venturing underground and conceiving mission architectures for robotic expeditions that explore skylights, lava tubes and caves. The investigation will identify effective designs for mobile robot architecture to explore sub-planetary features. By creating and implementing robotic technology to explore skylights, lava tubes, caves and canyons, this investigation will pioneer sub-planetary exploration.

Primary U.S. Work Locations and Key Partners



Project Image Technologies
Enabling Exploration of
Skylights, Lava Tubes and Caves

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Organizations Performing Work	Role	Type	Location
Astrobotic Technology, Inc.	Lead Organization	Industry	Pittsburgh, Pennsylvania

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Primary U.S. Work Locations

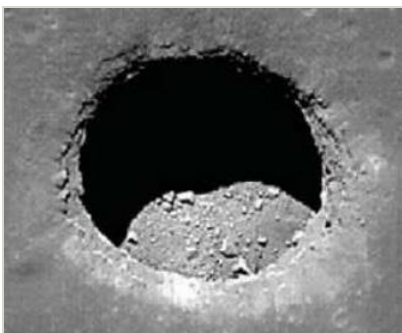
Pennsylvania

Project Transitions

**September 2011:** Project Start**September 2012:** Closed out

Closeout Summary: Robotic exploration of skylights and caves can seek out life, investigate geology and origins, and open the subsurface of other worlds to humankind. However, exploration of these features is a daunting venture. Planetary voids present perilous terrain that requires innovative technologies for access, exploration, and modeling. This research developed technologies for venturing underground and conceived mission architectures for robotic expeditions that explore skylights, lava tubes and caves. The investigation identified effective designs for mobile robot architecture to explore sub-planetary features. Results provide insight into mission architectures, skylight reconnaissance and modeling, robot configuration and operations, and subsurface sensing and modeling. These are developed as key enablers for robotic missions to explore planetary caves. These results are compiled to generate Spelunker, a prototype mission concept to explore a lunar skylight and cave. The Spelunker mission specifies safe landing on the rim of a skylight, tethered descent of a power and communications hub, and autonomous cave exploration by hybrid driving/hopping robots. A technology roadmap was generated identifying the maturation path for enabling technologies for this and similar missions.

Images

**15142.jpg**

Project Image Technologies
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(<https://techport.nasa.gov/image/102332>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Astrobotic Technology, Inc.

Responsible Program:

NASA Innovative Advanced Concepts

Project Management

Program Director:

Jason E Derleth

Program Manager:

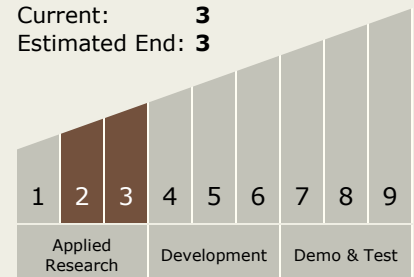
Eric A Eberly

Principal Investigator:

William Whittaker

Technology Maturity (TRL)

Start: 2
Current: 3
Estimated End: 3



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Technology Areas

Primary:

- TX04 Robotic Systems
 - └ TX04.2 Mobility
 - └ TX04.2.1 Below-Surface Mobility

Target Destinations

The Moon, Mars